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A NATURALIST'S YEAR.

By Grant Allen.

THE ROBIN COMES FOR CRUMBS.

WINTER has set in at last in real earnest. The hoar frost coats the naked boughs of the young birches in the clump upon the snow-clad lawn; the grasses by the bank arch over in dainty filagree with the bending load of drifted flakes that bow down their laden heads so heavily; and the poor little freezing sparrows, huddled together, half dazed, by the garden palings, hardly know how to move or cheep in the bitter cold that seems to paralyse their feeble fluttering, limp, wee wings. The time has fairly come for the exercise of indiscriminate out-door-relief to these small winter pensioners of our inexpensive human bounty. Let us throw open the breakfast-room window wide and drop out the crumbs from the trencher on to the flower-bed below, for the benefit of these sad little frozen-out workmen, who stand expectant with sidelong eye on the shrubbery bushes in grateful anticipation of their accustomed charitable feast. See, now they fly down timidly from their coign of vantage by the flowering laurustinus shrub. They love to shelter themselves there, close by, or else below the aucuba and the Portugal laurels, whose broad evergreen leaves hide them securely from our too curious gaze—and they are busy picking up the precious morsels, or squabbling with one another (like wee thieves that they are) for the bigger bits that any one among their number may have chanced to annex in the general scramble. But when they have all fed their fill, with much bickering and snatching meanwhile, our own familiar robin, who lives all winter in the garden as his fixed residence, comes boldly up for his share of the good things going so freely, and takes his stand upon the window-sill itself without fear or trembling, to eat the special meal that we lay out there, after the others are satisfied, for the sole gratification of our particular ruddy-breasted favourite.

It is curious how readily the acquired instinct of fear for man in these naturally timid little birds dies out before the exercise of a few weeks' steady kindness on the part of a single household. It shows how much less rigid in its action instinct really is, than most people in their hasty, unthinking fashion are too easily prepared to admit. The ordinary idea about an instinct is that it is something absolutely fixed and immovable—a tendency which will act under given conditions, no matter what the final effect; inexplicable, mysterious, and even perhaps a trifle miraculous. But when we come to consider a very simple case like this one, it is easy to see both how the existing instinct originally arose, and how it can even now be so rapidly modified under favourable circumstances. And to begin with, let us ask first, what is an instinct? in order to decide whether the fear of man on the part of the small birds is or is not really instinctive.

According to Professor Bain's excellent definition, an instinct is "an untaught ability," though it would perhaps be still more correct to describe it as unlearnt than as untaught, for most knowledge acquired by the lower animals is gained rather by experience than by actual communication. Knowledge or power, independent of personal experience, is indeed the key-note of instinct. Now, judged by this standard, it is clear that the fear of man is instinctive with each individual bird in England; for even very young birds, which have never seen a man before, are known to be very much frightened at the first apparition of that ancestrally alarming and very bloodthirsty animal, who has hunted them down, shot them with gun, or still earlier, with cross-bow, and shied stones at them (especially in his immature or cub condition, when he is commonly known as a boy) for many thousand generations at the very shortest computation. In existing European birds terror of this destructive and extremely cunning carnivore is hereditary and intuitive in almost every unprotected species.

The origin of the instinct, however, as Mr. Darwin has shown, is one on which we have an unusual amount of historical proof; for there are a few uninhabited oceanic islands where the native birds show no fear at all of man, and have to acquire the habit of fearing him by a long and painful course of practical teaching. In other words, the dread of human beings, though antecedent to experience in the individual, is not antecedent to experience in the race as a whole. There is nothing in the mere outward bodily features of the human face divine to make it immediately and naturally an object of uneasiness and terror to the eyes and brains of birds as such. It is only by continuous persecution throughout many generations that the fowls of the air at last come to inherit a nervous system, so constituted that the very image of a human being falling upon the retina causes an immediate and intense desire to effect an escape, without the bird itself being able to understand the why and wherefore of its singular perturbation. What a melancholy tribute to our boasted supremacy over all living things, that even the harmless small birds instinctively avoid us, as the hereditary enemies of their persecuted race! The sight of a man alarms them antecedently to all experience, much as the roar of thunder alarms ourselves, as the smell of lions alarms the camel, or as the sight of a snake alarms the monkeys bred in the Zoo, and therefore unfamiliar by personal experience with the feud which has always raged between their respective ancestors in equatorial forest glades. Yet, on the other hand, in the uninhabited Galapagos archipelago Mr. Darwin found the whole animal world so free from fear of man that he could push a hawk off a tree with the muzzle of his gun, catch the big amblyrhyncus land-lizards quietly by the tail, and collect the small birds to drink from a basin of water held between his own hands. This primitive tameness is not easily lost, either, for in the Falkland Islands, where the birds have been more or less hunted down at times for nearly two centuries, they have not yet acquired any

very great terror of aggressive man, though they are gradually getting less and less tame as time goes on. Even in England, the big birds are much more cautious than the small ones; and perhaps the very wariest of all is the heron, which has been hunted and hawked after in former times more persistently, in all probability, than any other of our native birds. The great bustard, now practically extinct in Britain, but still found on the continent of Europe, is even more preternaturally suspicious of man, the bustard-stalker, than the heron himself. On the other hand, sea-birds which breed on isolated rocks, and so have little opportunity for forming an acquaintance with the ways of humanity, like penguins and boobies, are often so tame that they can be readily caught with the hand or knocked over by dozens with a sailor's knob-stick.

The instinct of fear is thus very gradually acquired, and only by dint of much bitter ancestral experience: but when once gained, it is comparatively easily lost, and may even be replaced by affection and confidence after a very short acquaintance, not in captivity only (where the bird has no option), but in the native condition. Sparrows, which, as the most town-haunting of all birds, have had especial opportunities of learning the fickleness and treachery of man (still generally in the form of boy), do not so readily make friends with us as do robins; but in Paris, where the habit of taking a stray shot at every small bird is far less common than in London, everybody must have noticed how familiarly even these street Arabs of the winged world will perch upon the shoulders of the benevolent old gentlemen who feed them daily in the Tuileries gardens. In cold weather, starlings and thrushes are also very easily conciliated: and the far timider woodland birds themselves can be tamed by some few exceptional people who have the faculty of inspiring animals with a sort of intuitive confidence. I have often tamed mice myself by offering them crumbs at judiciously graduated distances, till at last they would come upon the dinner table to be fed, a habit which appeared to cause more fear to the ladies present than to the little visitors themselves. In Jamaica the turkey-buzzards, or local vultures, which are protected by law as useful scavengers, have learnt their immunity so well, and become so bold upon the strength of it, that they will even sometimes fly into the houses, whence they are only ejected by some display of physical force on the part of the rightful owners. I once saw three turkey-buzzards devouring a dead dog by the roadside; and in order to test their freedom from fear I tried to drive them off from the carrion with my walking-stick. The experiment was so eminently successful in proving their fearlessness that at the end of one moment it was the experimenter himself who was beating a hasty retreat in the direction of the nearest negro cottage, pursued by three exasperated and threatening vultures, who seemed disposed seriously to resent so unwarrantable an infringement on their ancient legal rights and privileges.

THE ZONE OF SMALL PLANETS.

By Richard A. Proctor.

(*Continued from page* 329.)

So soon as we consider the theory of the solar system's origin to which all the known facts point, we find—as it appears to me—an explanation of all those features of the ring of asteroids which had seemed most perplexing or (it is nearly the same thing) most significant.

The known facts are these—

First, the singular distribution of the masses forming the system. *Secondly*, the departures from uniformity, as in the various inclinations of orbits, and of the rotational movements of the planets. *Thirdly*, more marked departures from uniformity on the outskirts of the system, seen in the reversed movements of the satellites of Uranus and Neptune, and probably in reversed rotations of these outer planets. *Fourthly*, the existence of millions of meteoric systems, moving in all directions and at all distances from the sun, on paths having every variety of inclination and of eccentricity. *Fifthly*, the marked resemblances between the systems of Jupiter and Saturn on the one hand and the Sun's special family of small planets (Mercury, Venus, Earth and Moon, and Mars) on the other. *Sixthly*, the gaps in the mean distances of the asteroids. *Seventhly*, and for our present purpose *lastly*, the gaps in the Saturnian ring-system, which like the zone of asteroids consists of multitudes of small bodies.

As I showed thirteen years ago in my "Other Worlds than Ours," all the first four features of the solar system correspond with the theory that each member of the system was *in large part* formed (Laplace's nebular hypothesis need by no means be absolutely abandoned) by meteoric aggregation. Without this theory those features are absolutely inexplicable. And as, even now, though at a greatly reduced rate, the process of meteoric ingathering goes on, our earth yearly gathering in an enormous absolute mass of matter in this way, however small that mass may be compared with the earth's, we *know* that the theory is a true one—though in what degree the formation of the various members of the solar system is to be explained in this way, may of course be open to question.

With regard to the fifth feature, I know nothing more suggestive of the meteoric stream theory of the formation of the solar system than this. Anyone who has watched some mighty eddying, whirling stream, and has seen how perfectly the minor eddies in such a stream present in miniature the features of the greater whorl of which they form part, will see how strongly the resemblance between (for instance) the system of Jupiter and the central part of the solar system—the sun's special family as I have learned to regard it—suggests the idea of a minor eddy in a mighty whirlpool, like the minor whorls in the great whirlpool nebula itself.

But now be it noted that the sixth feature, the characteristic gaps in the asteroidal system—a strange and altogether perplexing feature without this theory—is precisely what we should expect to find in any case where meteoric aggregation led to the formation of a ring of small bodies instead of a separate planetary mass. [I would ask the reader before proceeding, here, to study the illustrative picture of the asteroidal family, supposed to be distributed in circular orbits at their proper mean distances (see p. 291, No. 106): he will recognise, I think, the force of the evidence, and see how the objection raised by Professor Newcomb on the strength of two or three asteroidal orbits *near* one of the gaps disappears when graphic evidence replaces mere statistical investigation.]

Every member of a meteoric stream moving in a period which synchronised (in a simple way) with the movements of Jupiter's giant mass would undergo at each return to conjunction with Jupiter the same kind of perturbation. This renewal of perturbation acting in the same direction would result in an accumulated disturbance, affecting the mean distance. We see this on a grander scale in the case of Saturn, whose period nearly synchronises with Jupiter's in such sort that five periods of the Giant Planet are nearly equal to two periods of the Ringed Planet: hence results what is called the Great Inequality. Now apart from other causes of disturbance, the effect in the case of

any individual meteor would be to cause its mean distance to oscillate on either side of that particular distance which corresponded to a period synchronising (simply) with Jupiter's. But considering the millions of meteors forming the system or stream, and that these would all have periods oscillating through this mean value, it is evident that at any given moment there would be multitudes of meteors moving in that period, or at the mean distance corresponding to one of the gaps in the asteroidal zone.

But now notice that the meteors thus passing outside and inside their proper mean distances would enter regions traversed by other meteor streams, and that, the members of such streams being counted by millions of millions, collisions could hardly fail to occur by myriads. Every collision would in effect be the withdrawal of a meteoric mass, small or great, which until then had had a period synchronising with Jupiter's; for in whatever way a collision occurred the mass resulting from the collision would have a period differing from that of either of the colliding masses.

Such processes would, in general, be part of the long series of processes leading to the eventual formation of a single planet. But just within the orbit of the mightiest of all the planets, Jupiter, and where the velocities due to solar influence begin to be great (this region being comparatively near to the sun) the combined disturbing influences would be better able than anywhere else throughout the solar system to prevent the formation of a single planet, and would lead, instead, to the formation of a zone, or rather a system of zones of small aggregations. These zones would be separated by gaps, either wholly or almost wholly free, corresponding to the distances at which Jupiter's disturbing influence would be most effectively exerted.

The circumstance that such gaps exist precisely where on this theory they would exist affords, certainly, strong evidence in favour of the theory.

But when we turn to the seventh point noted above the evidence seems to become decisive.

In the Saturnian ring-system we have a zone of multitudinous small bodies, travelling each in its own special orbit around the central ruling orb, Saturn. Whether we have here a region where other satellites besides those already formed around Saturn are in process of formation, or a region which will be, for all time, occupied by zones of tiny bodies, we need not here stop to inquire. It is sufficient that we have in the Saturnian rings, actually present before our eyes, a stage in the development of a system resembling the planetary family. Of course, it might be urged that here we have evidence of the bursting of two or three Saturnian satellites which formerly travelled around the planet where now we see two or three rings; but I hardly think this theory will be advanced, or (if advanced) successfully maintained. Setting it aside, we find in the Saturnian rings the analogue of the asteroidal system. *There*, on a small scale, are precisely such gaps as we have in the asteroidal system on a larger scale. The gaps are not quite free from small satellites, for if they were they would be as black as the shadow of the planet on the ring, and they are not black, but brown or dark grey. They are regions whence the small satellites have been almost wholly swept away. If the same sort of action can be recognised here that I have considered above in the case of the asteroidal zone, no manner of doubt should, I imagine, be entertained as to the validity of that interpretation of the gaps in the asteroidal system. But the very same cause has been recognised. Professor Kirkwood, of Bloomington, Indiana, with that keenness to detect such neat proofs which characterises him, and led me long since to call him the Kepler of modern astronomy, has shown that the gaps in the Saturnian ring system lie precisely where the perturbing action of the neighbouring satellites would be most efficient.

DARWIN ON INSTINCT.

"MULTIPLY, vary, let the strongest live and the weakest die." If not absolutely the last word, this is at least the last published utterance of the author of "The Origin of Species" and "The Descent of Man." In these ten words Darwin has expressed the conclusion of the whole matter, the ultimate result of a lifetime's patient and ceaseless research into the laws which govern terrestrial life. They are the concluding words of a paper by the late Mr. Darwin which his most faithful and loving disciple, Mr. G. J. Romanes, read recently at the Linnean Society. This paper, or "Posthumous Essay," as Mr. Romanes calls it, is the full text of a part of Darwin's chapter on Instinct written for the "Origin of Species," but afterwards suppressed for the sake of condensation. This and other papers on psychological subjects, to the elucidation of which from a physiological standpoint Mr. Romanes has devoted himself, Darwin gave to his disciple and friend, with the request that the latter should publish any parts of them that he chose in his works on mental evolution. Mr. Romanes, however, after Darwin's death, naturally did not feel himself at liberty to appropriate and incorporate in his works, as his own, so much material carefully collected and sifted by the master's hand, and the value of which had become enhanced. He, therefore, rightly decided to give the last, as Darwin himself gave the first, of the "Origin of Species" to the Linnean Society. The paper itself appears as an appendix to his work on "Mental Evolution in Animals," published by Messrs. Kegan Paul & Co. But that work contains much more of Darwin than the appendix. He had collected many notes bearing on the subject of instinct over and above the suppressed essay, and most of these notes Mr. Romanes has introduced into the text of his own work, always taking care to indicate their authorship, and giving, moreover, a special index to the passages.

In the essay before us, Darwin endeavours to throw light upon the origin of four manifestations of what is usually called instinct:—(1) Migration; (2) Instinctive fear; (3) Nidification and Habitation; (4) Habitations of mammals; and after a few miscellaneous remarks on the subject of instinct and on cases of special difficulty, he states his conclusion. The subject of the migration of birds is one of the most curious and complex in connection with what we call the instinctive habits of animals. But the tendency is not confined to birds, though in that class it seems most marked and developed. As usual, throughout this essay Darwin piles instance on instance to shed light on all sides of the special point under discussion. After adducing various instances to prove how widespread the migratory instinct is, and how in seeking to satisfy it birds of the most delicate structure will cross hundreds of miles of sea, he endeavours to show how the more remarkable migrations could possibly have originated. He says:—

> Take the case of a bird being driven each year by cold or want of food, slowly to travel northward, as is the case with some birds, and in time we may well believe that this compulsory travelling would become an instinctive passion, as with the sheep in Spain [referring to an instance he gives]. Now during the long course of ages, let valleys become converted into estuaries, and then into wider and wider arms of the sea; and still I can well believe that

the impulse which leads the pinioned goose to scramble northward would lead our bird over the trackless waters; and that, by the aid of the unknown power by which many animals (and savage men) can retain a true course, it would safely cross the sea now covering the submerged path of its ancient journey.

The section on instinctive fear is even more interesting than that on migration, and requires and receives delicate handling and cautious investigation; it is marked by all the features which are so characteristic of Darwin's previous works, including that scepticism which made him slow to accept, without personal examination, instances which seemed most strongly to lead to the conclusion that he was inclined to accept. He shows that in unfrequented islands the wild animals have rarely any fear of man, and that this feeling is only acquired after considerable familiarity with the methods of the animals' most dangerous enemy. He then, in considering the manifestations of fear and the methods adopted to escape the dreaded danger, refers to animals feigning, as it is said, death, "an unknown state to every living creature," which seemed to Darwin a remarkable instinct; so he resolved to test it in the case of insects. He says:—

Hence I carefully noted the simulated positions of 17 different kinds of insects, belonging to the most distinct genera, both poor and first-rate shammers; afterwards I procured naturally dead specimens of some of these insects, others I killed with camphor by an easy, slow death. The result was that in no one instance was the attitude exactly the same, and in several instances the attitude of the feigners and of the really dead were as unlike as they could possibly be.

Of course, this does not bear at all against the hypothesis that these insects assumed their motionless attitude through fear, but only disproves the prevalent belief that they instinctively or intentionally feigned death. Moreover, Mr. Romanes refers in the text of his work to several very remarkable and well-authenticated instances among the higher animals of the assumption of attitudes so death-like as to deceive the most experienced observers.

Equally interesting and much fuller of instances are the sections on nest-building among birds and the construction of habitations by the higher animals, as the beaver. Nests especially, Darwin shows, have all forms. He says:—

In the nests of birds we have an unusually perfect series, from those which build none, but lay on the bare ground, to others which make a most imperfect and simple nest, to others more perfect, and so on till we arrive at marvellous structures, rivalling the weaver's art.

He shows that birds, under certain conditions, where the end can be otherwise accomplished, will lose the instinct of incubation entirely, and that, in fine, nest-building in itself, and the multifarious forms which nests assume are determined by the principle of natural selection, by adaptation to special conditions.

Darwin then goes on to consider several instances of special difficulty—cases, for example, of an instinct appearing only once in the lifetime of an animal, which, however, he proves are perfectly explicable on the great principle, which under his hands has unravelled so many mysteries, the principle that it is a matter of life and death to all organisms to be able to adapt themselves to their circumstances; and the instances which he gives of disadvantageous instincts only serve to confirm the truth of the great principle. In his conclusion, he says:—

We have in this chapter chiefly considered the instincts of animals under the point of view, whether it is possible that they could have been acquired through the means indicated on our theory, or whether, even if the simpler ones could have been thus acquired, others are so complex and wonderful that they must have been specially endowed, and thus overthrow the theory.

He then goes on to refer summarily to the various forms and modifications in which it has been found that instincts present themselves:—

Bearing in mind that in a state of nature instincts do certainly vary in some slight degree; bearing in mind how very generally we find in allied but distinct animals a gradation in the more complex instincts, which shows that it is at least possible that a complex instinct might have been acquired by successive steps, and which, moreover, generally indicates, according to our theory, the actual steps by which the instinct has been acquired, inasmuch as we suppose allied instincts to have branched off at different stages of descent from a common ancestor, and therefore to have retained, more or less unaltered, the instincts of the several lineal ancestral forms of any one species—bearing all this in mind, together with the certainty that instincts are as important to animals as their generally correlated structures, and that, in the struggle for life under changing conditions, slight modifications of instinct could hardly fail occasionally to be profitable to individuals, I can see no overwhelming difficulty on our theory. Even in the most marvellous instinct known, that of the cells of the hive bee, we have seen how a simple instinctive action may lead to results which fill the mind with astonishment. . . . . The imperfections and mistakes of instinct on our theory cease to be surprising; indeed, it would be wonderful that far more numerous and flagrant cases could not be detected, if it were not that a species which has failed to become modified and so far perfected in its instincts that it could continue struggling with the co-inhabitants of the same region would simply add one more to the myriads which have become extinct. It may not be logical, but to my imagination it is far more satisfactory, to look at the young cuckoo ejecting its foster-brothers, ants making slaves, the larvæ of the ichneumidæ feeding within the live bodies of their prey, cats playing with mice, otters and cormorants with living fish, not as instincts specially given by the Creator, but as very small parts of one general law leading to the advancement of all organic bodies—multiply, vary, let the strongest live and the weakest die.

Such, then, is the clear and unmistakable conclusion of the posthumous fragment which Mr. Romanes has given in full to the world. It is the keystone, as it were, to the marvellous structure which, oppressed by almost constant suffering, Darwin spent his life in rearing. It may in the future be overtopped; it may, indeed, be only the central foundation for some larger and loftier structure, from the summit of which future generations may be able, with improved instruments, to see much farther into the mystery that surrounds us than we can ever hope to do; but it is impossible to conceive that it can ever be entirely swept away, that it can cease to be an important factor in solving the complex problems which will continue to present themselves to science, or that its author can ever be placed on a lower pedestal than that allotted to him by the greatest among his contemporaries.—*Times.*

HOW IS A LIFE ASSURANCE SOCIETY WORKED?

LET us hope there are not a few among our readers who are able to appreciate the advantages of life assurance. To such, a brief explanation of the principles upon which a life assurance society is worked may not be unacceptable; and at any rate it may show them and others upon what a secure system such societies are based, and may enable them the better to judge of the working and stability of any particular office.

Now, if the duration of life and the rate of interest were certain, any one could, by investing a certain sum at compound interest, secure a known amount at his death. To make this plainer: if every one died at 60, and the universal rate of interest were 3 per cent., a man of 20, by investing £1 a year at compound interest, would have accumulated at his death £75·4; and a man at 45, by doing likewise, would have £18·6. If then either of them

desired to leave £1,000 at his death, he would simply have to calculate what amount he would have to invest every year.

But, first, life is only too uncertain to admit of such a simple system as this; and it required the ingenuity of man to suggest a remedy by co-operation. A given area was taken, and the number of deaths at various ages were noted, and from these facts a table of the average duration of the lives in the area at the various ages, generally called a "Mortality Table," was drawn up. More recently the experience of the mortality among the members of several life assurances offices that had been established long enough to make their experiences reliable was taken, and a Mortality Table made out. Taking this last-mentioned Table, we find that if we take several healthy boys of 14, and several healthy men of 32, although all die at different ages—some only living a few years, and some attaining to a ripe old age—the average duration of the life of the boys will work out to 46 years, and that of the men to 33 years. Here then is the remedy for our difficulty, and if we deal with the masses, and if several boys of 14 pay us premiums of £1 a year during their lives, whether such boys' lives happen to be longer or shorter than the average, we shall with practical certainty not be losers if we agree to pay each on death the amount that £1 invested at compound interest will produce in 46 years, or £96·5, for one or other of them will pay us during their lives an amount which, if invested at compound interest, will produce that sum for each. And in a similar manner we can deal with the men, only, as their lives have the shorter duration of 33 years, we can only agree to pay each of them £55.

But secondly, the rate of interest is fluctuating, and not, as has been assumed above, 3 per cent.; and if the masses be dealt with, there will be expenses of management to be provided for, and, may be, occasional losses and bad debts. With the most careful calculation it would, from their nature, be difficult to equilibriate these items with mathematical precision. Then, too, it would not be prudent to trust too implicitly to the correctness of the tables. Life assurance societies existing for the purpose of provident and not risky investment, and the ability to meet the death claims made on them being of the first importance, it is desirable and usual that these fluctuating items should be more than covered, and this is done by the premiums actually asked being greater than calculation may show to be absolutely necessary. The result is that the boys and men in our example would have to pay (say) 25s. instead of 20s. a year. The profit made by premiums being excessive is divided every few years,—in a mutual office among the assured, in an office having proprietors, among the proprietors and the assured. In a mutual office, therefore, the assured are not hurt by excessive premiums, the excess being returned with interest. But in an office having proprietors the assured will be affected by excessive premiums in proportion to the amount of the profits to which the shareholders are, by the constitution of the office, entitled; and in either office the assured would be affected if the division of the profits among them—the distribution of "bonus" as it is called—is not equitable. If, for instance, it is so arranged as in effect to rob the younger lives to make the older policies more valuable than they ought to be.

Aurora, Ill., and Ogden, Utah, are, learns the *Electrical Review*, lighted by electric lamps, the power used being that of waterfalls. An electric lighting company proposes to utilise the power of the Genesee Falls at Rochester, N.Y., and is putting in turbine wheels for the purpose.

Reviews.

HOW TO SEE.*

By Richard A. Proctor.

A FEW months since I met, for the first time, the great and genial philosopher Professor Fiske, of Boston, Mass. He was so wonderfully cheerful, that I felt disposed to ask a question akin to that asked in a well-known Bab Ballad, of the Gentle Pieman,

> "Why so very very merry,
> Is it purity of conscience, or your one-and-seven sherry?"

I refrained, however; and he presently explained. "I have been revelling this morning," he said, "in a new pair of spectacles:" which struck me as almost as odd as revelling in one-and-seven sherry, till he explained that for years he had been troubled by ill-suited spectacles, and that "our friend Mr. Browning" had at a first trial provided him with a perfect pair.

In the book before us, Mr. Browning shows how he manages thus to correct imperfect vision, nay, how cases more difficult than Professor Fiske's can be satisfactorily dealt with. (He mentions that particular case at pp. 62, 63.) The book is full also of useful hints and suggestions about the eyesight generally. He points out, truly enough, that sight, the most precious of our senses (for if we have sight we can both speak and listen, even though deaf and dumb), is allowed to become impaired and all but lost before skilled advice is sought for, whereas for the least defect of hearing a surgeon is consulted.

Although a portion of the work appeared in these columns, the greater part is new—and we believe readers of Knowledge would have been glad to get the work even if it had only contained what appeared here, so useful was the information there brought together.

I am myself particularly interested by what Mr. Browning says respecting his way of dealing with eyes of unequal focal length. My left eye is simply useless for distant objects, though of marvellously sharp vision for objects close by. My right eye is of the usual average focal length. I can fully confirm the statement of one who consulted Mr. Browning about such disparity of vision, that spectacles abruptly correcting it cannot be worn without distress for more than a few minutes. How Mr. Browning worked up to a satisfactory solution of the problem—is it not recorded in the book before us? I shall certainly try this way of doing what all my life I have failed to do—to see, namely, with both eyes at once.

Every one who cares about his eyesight should get this little book: those who think their eyesight of no particular moment can very readily dispense with it.

NATURE'S ENERGY.†

This is at once a very useful and a highly interesting little work, holding a place midway between such works as in former times Neil Arnott and Dionysius Lardner wrote about physical matters, and the technical and, to say the truth, rather dry treatises in which the same subjects have been discussed by some of our modern physicists. Mr. Carpenter, son of one of the most eminent men of science

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* "How to Use our Eyes." By John Browning, F.R.A.S. (Messrs. Chatto & Windus, London.)

† "Energy in Nature: a course of six lectures upon the Forces of Nature and their mutual relations, delivered under the auspices of the Gilchrist Educational Trust. By W. L. Carpenter. (Messrs. Cassell & Co., London.)

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of the day, has had experience, in lecturing, of the requirements of the general public, not necessarily less instructed all round than those who undertake to teach, but needing clear and simple information, free from technical details, respecting the leading truths of special branches of science, with which the teacher has made himself familiar. There is no greater mistake, we are convinced, than is made by those lecturers and writers who regard their audiences or readers as ignorant persons to be addressed in condescending tone and with childish words. Clearness and simplicity are all that the teacher needs to go straight to the understanding of his audience. Expressed clearly and simply the grandest truths of science while they lose nothing of their impressiveness become acceptable to every reasoning being—a term which does not include those who are so enamoured of a special subject as to have no room in their minds for other matters.

Mr. Carpenter's subject is "Energy in Nature" in all its varied manifestations,—as Heat and as Mechanical Energy, as Light, as Magnetism, as Animal and Vegetable Energy, as Gravitation, as Cohesion or as Radiant Energy.

In the first lecture our author discusses matter and motion, force and energy. In this lecture a very clear and succinct account is given of the laws of motion; but we must take some exception to the remark that "although a body may be apparently at rest, it may have a very decided *tendency* to move," as likely to be misapprehended. A condition of readiness to respond to any application of force can hardly be called a tendency to move. The case cited by Mr. Carpenter, of two weights carefully balanced and then moved with a slight addition to either, indicates no tendency to move: the velocity acquired by the total moving mass at the end of any given time is precisely that resulting from the downward tendency of the added mass, applied to the total mass moved, less such effect of frictional resistance as may be excited during the motion. If the small moving weight may be neglected as compared with the large balanced weight, then when these are doubled, trebled, quadrupled, &c., the resulting velocity is reduced to one-half, one-third, one-fourth. A weight of 2 lb. hung by a long fine thread *begins* to move more readily under slight side pressure than two balanced weights of 1 lb. each,—but because it is freer to move, not because of greater or less tendency to move. This, however, is but a slight defect in a very interesting chapter. The chapter on Heat gives a very complete and interesting account of all the principal facts to be noted in connection with heat regarded as a form of energy. Here again we pass over all the excellent descriptions and explanations, to touch on a passage which seems likely to mislead,—with no unfairness however of intention, but rather dwelling on the fact that the point seems the only one which needs correction; the rest of the chapter can take care of itself. Mr. Carpenter says that radiant heat and light are not identical though propagated in the same way: the waves which affect the sense of touch as heat are much longer than those which affect the eye as light. This, of course, is not strictly correct. There are rays which affect the sense of touch as heat and affect the sense of sight as light. To such rays glass which is opaque to obscure heat rays is as we know not opaque; while iodine in solution, which is absolutely opaque to light, is as absolutely opaque to heat waves of this kind. The more correct way of putting the matter would have been to say that waves between certain limits of length affect the sense of sight as light; and that while the shorter of these waves do not affect the sense of touch as heat the longer ones do, while longer waves still, though not affecting the sense of sight, affect the sense of touch as heat in a still more marked degree than even the longer light.

We note also by the way that the statement at the foot of p. 42, to the effect that "there is good reason for believing that oceanic circulation is due rather to polar cold than to equatorial heat" seems open to serious question. To us it seems like saying that the processes attributed to the sun's heat are really due to the cold following his absence from the sky.

The chapters on Chemical Attraction (including combustion), Electricity and Chemical Action, and Magnetism and Electricity are full of interesting matter. But the most interesting and valuable chapter of all is, in our judgment, the sixth, on Energy in Organic Nature. The comparison between the animal body as a machine (p. 189) and the very best forms of steam-engines as earlier described at p. 54 is worthy of the most careful study. The discussion of the value of various forms of food, though necessarily brief, is excellent. We may say of this chapter that while not one man in a thousand can afford to be ignorant of the facts here dealt with, we doubt whether they are really known to one in a million.

THE WAYS OF SOME INDIAN INSECTS, BEASTS, AND BIRDS.*

This is a delightful book, irresistibly funny in description and illustration, but full of genuine science too. The fun which E. H. A. finds in the ways of insects, beasts, and birds belongs in truth to the poetry of this part of science, as certainly as the solemn mystery of the star-depths belongs to the poetry of astronomy. And as the fun of our author is full of poetry so does it verge now and then on the terrible or the pathetic. How humorously he describes the microphonic ears and the distant-smelling nasal appendages of the demon bat; but we are more disposed to shiver than to smile when he goes on to show how this deadly creature hears and scents its prey. "Those ears are fit to catch the gentlest rustle of the feathers of a dreaming sparrow," its nasal trumpets "gather the faintest odour of the sleeping prey as the demon bat floats past upon the air." "It scents a sparrow asleep with its head cosily buried in its wing. The sparrow has a dream, a dreadful dream; it starts and raises it head and gives a piercing shriek and the curtain falls——In the morning two wings are lying beside the flower-vase upon the table, and perhaps a beak, though the demon bat eats head, skull and all, before any other part."

Take again what E. H. A. says about lizards:—They "once were great, the aristocracy of the earth. What a strange world there must have been on this same earth of ours in those days! Did mosquitoes as large as sparrows, with voices like tin trumpets, infest the swampy wastes and torment the drowsy *megalosaurus;* and did the winged lizards, like flying foxes, hawk them in the dusky forests? Did the mild *iguanodon*, when it had done browsing on a tuft of maidenhair fern about the size say of a clump of bamboos, turn round and waddle away into a hole, as its successors do to-day on the plains of Guzerat? The lizards are the wrecks of a great past. They had their day; perhaps they abused it: at any rate the great unresting wheel has gone round, and that which was up is down. The commonalty do not seem to feel it much. But all the descendants of great families, the crocodiles and alligators, and even iguanas, are a prey to melancholy. They maintain a dignified spiritlessness which is affecting." "Like

* "Tribes on my Frontier: An Indian Naturalist's Foreign Policy." By E. H. A., with illustrations by F. C. Macrae.

all races whose greatness is a memory, lizards are sensual, passionate, and cruel"—Passionate! "Two sparrows will squabble and scuffle, until they get so inextricably mixed that, when they separate, it is quite an open question whether they have got their own legs and wings or each other's; and two ants will fight until they die in each other's jaws, and a third come up and carries off the whole jumble for the food of the community; but for an example of devouring rage go to the big garden lizard, which the children in India call a blood-sucker. See it standing in the middle of the road, its whole face and throat crimson with wrath, and swollen to the bursting point with pent-up choler, its eyebrows raised and its odious head bobbing up and down in menace of vengeance. And the explanation of the whole matter is that another smaller lizard snapped up an ant on which it had set its heart. Nothing will appease it now but to bite off the offender's tail. This will do the latter no harm, for a lizard's tail is a contrivance for the saving of its life, planned on exactly the same principle as the faithful Russian slave, who threw himself to the wolves that were pursuing his master's sledge. I once saw a fierce scorpion catch a lizard by the tail and plunge its sting into the wriggling member; but before the venom could circulate to the lizard's body it detached its tail and ran away grinning." The illustration is splendid: the lizard is grinning indeed, and conscious of the humorous aspect of the matter; yet can a lurking feeling be detected that on the whole he would rather have kept the tail if he could have done it safely. "The scorpion went on killing the old tail, and the lizard began growing a new one."

The migrations of the *Callidryas* (Butterfly so named by E. H. A.) give an interesting illustration of Mr. Wallace's theory that migratory instincts are among Nature's devices for keeping down surplus populations. When once set a-going, the Callidryas keep going. With scarce a pause to rest their wings or sip a flower, from eight or nine o'clock until the afternoon, as far as eye could reach, the host kept streaming past like the fugitive Gauls after one of Cæsar's great battles. And in their fate, too, they resembled those barbarian hordes, when a deep river at last barred their weary way, and they tumbled headlong, one upon another, into its reddening waters; for I stood again another year beside the Bombay harbour, and watched the frenzied myriads hurrying from the mainland over Elephanta, and across the sea and over Bombay or Karinja—for their direction was southerly—and *then?* Then I suppose, over the sea, and on and on and on and on, until darkness settling down on them, and their amazing strength at last ebbing away, they must have dropped into the waves, each one, as it fell, creating and perishing in a small South Sea Bubble of its own; and the fishes had a feasting to be remembered.

E. H. A. is not altogether a follower of Darwin. Speaking of the mosquito, he says: "Huxley has abolished teleology, and Darwin has proved to the satisfaction of every one who is disposed to agree with him, that no characteristic in any animal can be explained by its being beneficial to some other animal" (he is referring here to a theory of his own, started earlier by Mr. W. Mattieu Williams, that the mosquito was designed "to promote a healthful use of Nature's currycomb among a class of people too much accustomed to regard water only as a means of quenching thirst"). "Only those peculiarities," according to Darwin, "are maintained and developed which are advantageous in some way to the animal itself, and give it a pull over others in the struggle for existence. And so we are plunged in a mire of perplexity. For what possible gain can it be to a mosquito to gorge itself in my life-blood until its wings almost refuse to carry it and it can just sail slowly, like some great crimson balloon, with the wind, positively inviting me to imbrue my hands in my own blood. Insects require no food in their winged state—at least the flimsier kinds do not, such as flies, gnats, and butterflies. They have done all the serious business of life, the eating and growing, in their grub state, and when they dress up and come out into the world to enjoy a few days of vanity before they die, they have no proper mouths, only a sort of tube for sipping light refreshments. But supposing mosquitoes do require nourishing food—why can they not bleed us painlessly? Why make us pay fees of anguish for the operation? The traveller who invented the vampire bat understood matters better, and made the horrid monster fan its victim gently with its ample wings," . . . and so forth, till finally E. H. A. tells us he holds "that Darwin weighed in the balance against the mosquito is found wanting."

Very quaint yet very suggestive of close observation is E. H. A.'s remark that "if there is a scrap of truth in the development theory, the crow's way of examining everything with one eye must certainly bring on an eyeglass in time." Bring on an eyeglass!

But we have marked so many passages for quotation and comment that four or five numbers of KNOWLEDGE would be required to present them all. We must content ourselves with the remark that there is not a dull or uninstructive page in the whole book.

THUNDERSTORM AT BOURNEMOUTH.—A very severe thunderstorm passed over Bournemouth recently, the lightning striking the chimneys of Little Forest House on the East Cliff. The house was not occupied at the time, and the fire was therefore not immediately discovered. The building was burnt to the ground. Some valuable pictures were saved by the fire-brigade, but the remainder of the property, worth several thousand pounds, was destroyed.

ACCIDENTS FROM LIGHTNING AT CYPRUS.—On October 31, during a violent thunderstorm, a native who was riding near the village of Archa was struck by lightning, and he and the mare he was riding were both killed. On the same day a woman and an ox were struck dead by lightning at Sotira; and near the same village, on the following morning, a man and a mare he had been riding were found dead, having been struck down by the electric fluid.—*Cyprus Herald.*

THE TELEPHONE DURING THE JAVA EARTHQUAKE.—While the eruptions of the volcano Krakatoa and the shocks at Java were proceeding, it was impossible to use the telephones at Singapore, in consequence of the noise in the wires. The sound was like that of a distant waterfall. On one line, part of which was submarine, detonations like pistol-shots were heard.

THE VICTOR EMMANUEL GALLERY.—The covered street at Milan, now well known under this name, is roofed with glass, and completed by a large dome, round the interior of which runs a chain of gas-lamps. The lighting of these lamps at a considerable elevation used to present some difficulties, and was always a source of risk, until an arrangement was made for doing the work by electricity. A miniature railway has been constructed close to the gas-burners, on which runs a little electric locomotive carrying a wick steeped in spirits of wine. When it is desired to light the burners, this wick is set on fire, and the locomotive started on its career. It flies round, rapidly kindling the circle, and exciting great interest among the crowds that assemble nightly to witness the performance.—*Engineering.*

XUM

THE EARTH-FLATTENER'S CHALLENGE.

By Richard A. Proctor.

A LETTER from the Zetetic Society points out (1) that Parallax claims to have seen, not the structure of a bridge, but a boat (through a telescope), six miles away, his eye being close to the water's edge: his law of perspective, though inconsistent with the laws of nature and observed facts, is not inconsistent, it seems, "with *this* fact." I dare say not. The impossible things seen by Parallax are doubtless quite consistent with his imaginary law. But to one who like myself has swum in lakes and rivers in all parts of the world, and in seas as still as the calmest lake, it is well known that what Parallax claims to have seen he never did see. True, I have not swum with "a good telescope" at my eye; but I have seen objects in the water with perfect distinctness to the water's edge at a mile's distance when my eyes have been six or seven inches above the water; so that when I have seen the water line rise up and hide those objects as my eyes have approached the water level, I have known that no new law of perspective, but the water's rotundity concealed them.

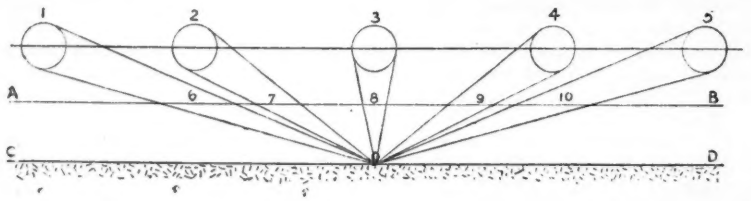
The Zetetic Society invites me to repeat Parallax's experiment of firing a gun tied vertically, to see whether it is or is not utterly incredible that two shots out of fifty might fall back into the muzzle of the gun. I utterly decline. If I missed killing myself, I should probably kill someone else: I may very literally say therefore, "I'll be hanged if I do." Considering, however, that thousands of experiments on falling bodies show that with the most delicate appliances to avoid disturbance, bodies let fall within places carefully shielded from the external air have not in a single instance fallen either,—exactly in the calculated place, or exactly below the point of suspension, or any two in precisely the same place, I must be excused for utterly declining to believe that two balls out of fifty *fired* from a gun *tied vertically*, fell back into the muzzle. I should have been quite sure independently of this statement that Parallax would not stick at a trifle in the way of invention; but if he had before been known to me as the original Unclothed Dweller in a Well I should still have unhesitatingly rejected this story.

With reference to the *Times'* note in which mention was made of the Pole Star being seen from latitude 23°, the representative of the Zetetic Society thinks it must have been south latitude, because the North Pole is always above the horizon in 23 N., "and the *Times* being a carefully informed and well written paper, we must infer that south latitude was meant." The inference is an odd one. The passage occurred under head "Naval and Military Intelligence," and related to a war-ship or transport-ship whose return was announced. It merely meant that on such and such a day, a latitude observation of the Pole Star showed the ship to have been in latitude 23°, not that on that day the astounding observation was made that the Pole Star was visible from latitude 23°: though that would indeed have been an astounding observation if 23° south latitude had been in question. But I would invite the Zetetic Society (before they accept their many-named founder at his own valuation) to observe that he manifestly spoke falsely over this matter, since the ship in question—no flyer—reached Southampton at a date mentioned in the report, and she would have had to fly indeed to have reached that port from 23° south in the time shown; whereas from 23° north, some 3,200 miles nearer, the journey was very comfortably accomplished.

The Zetetic Society then proffers an explanation of my first problem, an explanation which is so far from even any pretence at validity that at first I was disposed to regard it as a joke. Having satisfied myself that it is *not* so meant, I give it, not to amuse readers (though it will) but to show the utter hopelessness of any attempt to set right persons who can be deceived by such ludicrous pretence of reasoning.

Query.—Why, despite the enormously varying distance of the sun (while yet it is day) according to their theory, the sun does not vary correspondingly in apparent size.

"His size does vary, as everybody knows, mostly in rising and setting, and quite in accordance with the theory of *flatness*, and on the principle that a luminous body of a given diameter does not subtend the same angle as a non-luminous body of the same magnitude and at the same distance. The diagram will show also that, as the sun recedes from the meridian, over a plane surface, the light, as it strikes the atmosphere, must give a larger disc."



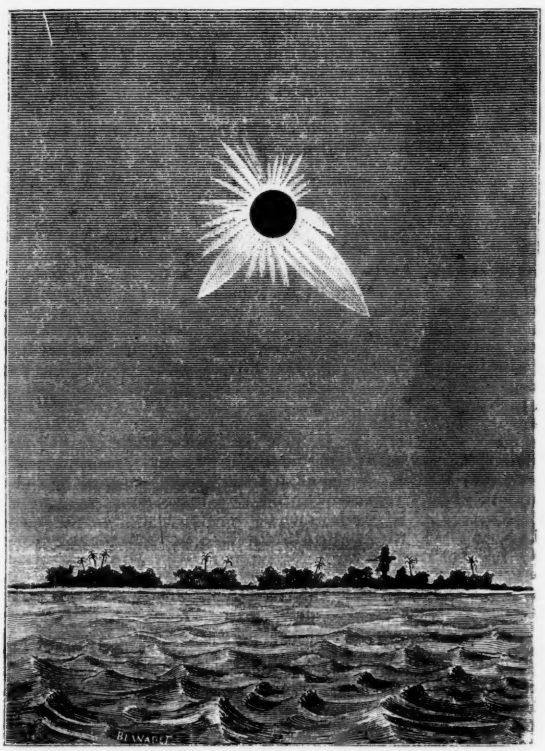
"Let A, B, represent the upper stratum of the atmosphere; C, D, the surface of the earth; and 1, 2, 3, 4, 5, the sun in his morning, forenoon, noon, afternoon, and evening positions. It is evident that when he is in the position 1, the disc of light projected upon the atmosphere at 6, is considerably larger that the disc projected from the forenoon position, 2, upon the atmosphere at 7; and the disc at 7 is larger than that formed at 8, when the sun, at 3, is on the meridian; when at 4, the disc at 9 is again larger; and when at 5, or in the evening, the disc at 10 is again as large as at 6, or in the morning position. It is evident that the above results are what must of necessity occur if the sun's path, the line of atmosphere, and the earth's surface, are parallel and horizontal lines. That such results do constantly occur is a matter of everyday observation; and we may logically deduce from it a striking argument against the rotundity of the earth, and in favour of the contrary conclusion, that it is horizontal. The atmosphere surrounding a globe would not permit of anything like the same degree of enlargement of the sun when rising and setting, as we daily see in nature."

"With regard to the remaining three questions," proceeds the representative of the Zetetic Society, "we do not think they have any bearing on the subject. Parallax and his followers do not pretend to solve all the problems so as to reconcile them with his doctrine. It has taken nearly three centuries to reconcile certain phenomena with the theory of rotundity, and scores of them still remain unreconcilable. We do not doubt that in time all such questions will be solved each in its turn, so long as the premises are based on data which are capable of being tested and demonstrated in accordance with *facts* and *truth*."—H. Ossipoff Wolfson, Secretary, Zetetic Society of Great Britain.

I propose to wait, all the same, until the Society is good enough to explain why when their system puts the sun at certain times in certain positions, he *shows himself* in quite other positions. These questions may have no bearing on the Zetetic theory: for they are reasonable and the theory is not. But the Zetetists must be content to wait for further notice till they have a reasonable theory.

THE ECLIPSE OF LAST MAY.

WE give this week a most interesting picture of the solar corona as drawn by M. Trouvelot during the eclipse of last May. M. Janssen's report mentions that all the forms shown in the picture were seen with singular distinctness. The eclipse is remarkable for the success with which Janssen examined the spectrum of the corona for the Fraunhofer dark lines of which he placed about a hundred, showing clearly that the corona's light is in part reflected sunlight. M. Tacchini detected in the spectrum of the great coronal plume the bands shown in the well-known spectrum of comets. It need hardly be said that



M. Janssen mentions only to dismiss with a smile Dr. Hasting's notion that because signs of the effects of diffraction can be detected in the corona, therefore the corona is wholly a phenomenon of diffraction.

Editorial Gossip.

I FIND so much that is really scientific, as well as amusing, in Mr. Trotter's poem that I have inserted it as it stood. I had occasion to make a little note upon one part of it, and as I found a prose note had a comical effect I ran the note (with as little change as possible) into rhymed form.

OVERHEAD WIRES.—The agitation against overhead wires has lately received some support from the risks incurred by firemen and spectators during the progress of fires. While the great Glasgow fire was raging, a considerable number of wires came down, and at Nottingham, last week, the fire which destroyed the large oil-mill melted the wires crossing the burning premises.

TIME TURNED BACK.*

BRING out Imagination, and we'll put her to the Car,
And harness fitful Fancy, for to-day we travel far,
Due northwards our direction, and through chilly gloomy Space,
One hundred and six five billion miles,† and at a rattling pace.

* * * * *

Now stop, and turn our telescope towards the distant Earth,
And we shall shortly see how much our expedition's worth.
We've found it: now bring England to the middle of the field;
Slip on a higher power that will good definition yield.
Here's a quiet Hampshire village, that we've never seen before,
And 'tis as though we stood before a lowly cottage door;
And peeping through the lattice, there's an aged woman sitting
In an arm-chair by the fireside, feebly toiling at her knitting.
Who's this weather-beaten soldier bursting through the cottage door?
'Tis her son—and see, she knows his footstep on the sanded floor—
Just back from the Crimea: no more battles, night alarms,
No more hardships and privations.

* * * * *

Leave him in his mother's arms
And away again at twice the speed of light—'tis quickly reckoned,
You'll find 'tis‡ nigh three seven three thousand miles through Space per second.

* * * * *

Now through the cottage window there's a sight that makes one glad,
As the thankful mother kisses the brown cheeks of her dear lad.
But see, the two are separatin,g and with outstretchèd arm
The good old lady sinks into her chair, and with a calm
And unexcited manner, in the firelight gently rocking,
Is quietly at work, but is unpicking her new stocking.
The soldier striding backwards, his strong arms are still stretched out—
Backs through the door which opens of itself to let him out.
A last glance within the window shows us plainly, if we wait,
We shall see the soldier's mother, who now wipes a pewter-plate,
Engaged at supper; but the sight would surely turn us pale,
So over the description, we had better draw a veil.
The soldier backs along the road—to him it's not surprising
That in the glowing western sky the evening sun is rising,
And that the busy village mill, with never-ceasing clack,
Makes grain from flour, and with the wheel it laps the mill-stream back.
And that the reeds in yonder brook, where gurgling eddies gleam,
Nodding their heads, bend forward low against the rapid stream.

* * * * *

* Suggested by "The Stars and the Earth."
† 165,000,000,000,000 ($=165 \times 10^{12}$). ‡ 372,800.

XUM

We'll hasten onward from the Earth, for Fancy knows no limits,
The story of the previous weeks whirls by in a few minutes.*
Now past Gibraltar, Malta, Greece, the ships sternforemost skim:
Whoa! slacken speed to former rate, for see, the air grows dim,
And muskets flash, and cannon blaze, the battle's all around,
But as we have no telephone there's not the slightest sound.
The movements are confusing 'twill be better if you please;
To travel at a slower rate, and see things at our ease.
Our soldier is a gunner, and he ought to think it fun,
For here the clouds of smoke grow thicker, rolling t'wards the gun;
They gather at the muzzle, now, and with a blinding blaze,
The shot comes up and drives them down the barrel as we gaze.
An officer unwriting a dispatch, by "Raglan" signed,
The pencil gliding to the right leaves paper clean behind.
The battle, as we've hinted, does not seem so very sad,
For the dead on all sides rise up, although many wounds are bad;
And now the bullets quit their bodies, leaving unharmed skin,
And finding their respective muskets, with a flash go in.
The cartridge-cases fill, and soon the cannonadings cease,
The troops march backwards to their camps, and all again is peace.
Now home again, lest some fixed star's attraction should allure us,
For now we're more than twice as far from Earth as is Arcturus.

* * * * *

At first it seems impossible to witness bygone scenes,
But it is not unthinkable to us by any means;
The laws of Physics on this Earth, we cannot but obey:
This does not contradict the laws of Thought in any way.

A. P. T.

The *Railway Review* (Chicago, October 6) copies from the Pittsburgh *Dispatch* an account of the tunnel lately completed, under part of the city, for the Pittsburg, McKeesport, and Youghiogeny Railway. The ground was covered with buildings and piles of metal, &c.; it was chiefly composed of cinder, and intersected with sewers and pumping mains connecting the river with numerous works. Thousands of tons of metal, ore, sand, &c., had to be moved for the purposes of the survey; and when the works were begun, every foot of the way had to be shored up, for the protection of the workmen from the loose, cindery soil. All difficulties were, however, overcome, and the tunnel, 165 ft. long and 18 ft. high, was completed in a few days over a year, with only the loss of a single life.

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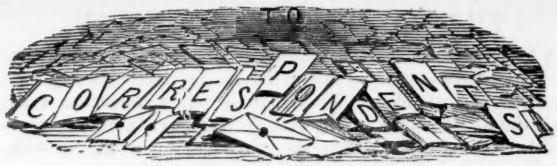
* Just here I would throw in a note suggested by this poem
(On things that we can surmise, though perchance we never know 'em).
This voyager in space, as our deponent seems to say,
Saw more than had elapsed within the compass of a day;
But all that time the earth was swiftly turning without jars,
And the places seen from far away were turned tow'rds diff'rent stars.
So to see those places clearly during several days' expiral,
Our trav'ller must have voyaged in a most amazing spiral.
See this subject lightly touched on in my cheerful little treatise,
Called "Geometry of Cycloids," which for seaside reading meet is
(It's advertis'd, I notice, in the outside sheets of Knowledge,
But the bulk of it I worked out in my "salad days" at College).

R. P.



"Let Knowledge grow from more to more."—Alfred Tennyson.

Only a small proportion of Letters received can possibly be inserted. Correspondents must not be offended, therefore, should their letters not appear.

All Editorial communications should be addressed to the Editor of Knowledge; *all Business communications to the* Publishers, *at the Office, 74, Great Queen-street, W.C.* If this is not attended to delays arise for which the Editor is not responsible.

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The Editor is not responsible for the opinions of correspondents.

No communications are answered by post, even though stamped and directed envelope be enclosed.

THE EXTRAORDINARY SUNSETS.

[1039]—I have just read Mr. Ranyard's communication in this day's Knowledge on the above subject, and find that he has arrived at the same theoretical conclusion as myself. To test its soundness, I placed some strips of glass in an exposed position, and examined the dust deposited thereon in order to ascertain whether it included any evidence of meteoric iron. The results have been equivocal. I found traces of iron, but until the last few days the wind has blown from the south and south-west, and thus has brought me so much London smoke that no reliance may be placed on such traces. The snowfall of Wednesday and yesterday has, however, come to the rescue. The wind that brought it is from the north and north-west, which reaches me after crossing the Weald of Harrow, and that curious district around, which, though so near to London, is one of the most thinly-peopled parts of England. The virgin snow carefully collected from my garden at a distance of 80 yards from my chimnies, and about half a mile from any to windward, is thus a fair sample.

On thawing some of this that had been collected by slicing off the top film of the snow with a piece of glass, I found a sediment of fine brownish-black powder. Ferrocyanide of potassium added to the snow-water produced no change of colour, showing the absence of iron in solution there, nor was there any visible reaction on the black dust until I added some hydrochloric or nitric acid. Then the characteristic blue compound indicating iron was abundantly formed all around the granules, and presently, as their solution was effected, a bluish-green deposit was formed, and the whole liquid deeply tinged with the same. It was not the true Prussian-blue reaction of iron alone, but just the colour that would be produced by mixing small quantities of the cyanide of nickel (yellowish green), with a preponderating amount of Prussian blue.

I have posted to Mr. Ranyard the precipitate obtained from 1½ oz. of snow, and he will probably be surprised—as I was—at its quantity. There is no doubt about the iron, but the nickel demands further investigation before its presence is demonstrated. The green tinge is merely suggestive. If it is really there, the evidence of cosmical origin of the material brought down by the snow will be overwhelming.

The iron appears to be in the condition of magnetic oxide. The particles that I have examined in the microscope do not display the pear-shape which has been described as characteristic of meteoric dust. They are more like agglomerations of minute spherules, and with them are the usual crystalline and organic particles found in dust. Never having examined unquestionable meteoric granules I am unable to speak with any confidence concerning the microscopic evidence afforded by these. W. Mattieu Williams.

Stonebridge-park, *Dec.* 7, 1883.

[1040]—I think that I can give categorical replies to two of the questions suggested by Mr. Ranyard's very interesting article on p. 341. The first snow fell here (very slightly) on the 5th, followed by a much heavier fall on the night of the 6th and the morning of the 7th. The sunset on the latter evening was a tolerably fine one, but the astonishing after-glow of the preceding one was no longer visible. I have examined the deposit from about a gallon of snow carefully collected, and find under the microscope that it is full of

particles of iron, easily separable by a magnet from the organic dust (of which, by-the-bye, there is very little) accompanying it. The wonderful crimson of the sky here on the nights of the 4th and 5th were accompanied by the beautiful spectacle of a Green Moon. My own idea was that this was simply a retinal effect of contrast; but that very accurate and painstaking observer, Mr. H. Pratt, F.R.A.S., of Brighton, seems to have examined the moon with a two-inch achromatic telescope, so as to cut off all the light of the sky, with the result that he "found the bluish-green tint of the moon more decided and beautiful than before." This would seem to point to the dichroism of the reflecting medium—whatever it may be—to which we are indebted for the recent gorgeous phenomena. I may add that my butler tells me that this morning's sunrise was similar to some of the recent abnormal ones; but I did not see it myself.

Forest Lodge, Maresfield, Uckfield, WILLIAM NOBLE.
Dec. 10, 1883.

LUNAR SHADOWS.—STRANGE SUNRISE AND SUNSET EFFECTS IN LANCASHIRE.

[1041]—I read with interest the Rev. J. W. Webb's article in KNOWLEDGE, of Nov. 16th, on "Lunar Delineation"; but he seems to me wrong in saying that the "shadows are of unbroken blackness," owing to the want of a "reflective atmosphere," and that the facility of delineation would therefore be increased! If such were the case, a moon-picture would indeed be a simple affair—nothing but fields of light surrounded by utter blackness. Now, one reason a moon-picture would be worth doing is that, although the sky or space behind the mountains would be absolutely black, there is no reason why the shadows in the mountains should be so; on the contrary, they might be full of bright reflections from the intense glare on the exposed parts of rock, and—as the Rev. J. W. Webb well knows—a moment might be chosen when only the highest peaks catch the sun's light, so that the rest of the rocks and foreground might be without any sharp shadows at all. I don't understand why he uses the words "reflective atmosphere." Isn't it enough to say that the moon is without atmosphere?

At Coniston we have had wonderful effects over the lake. I have been in the habit of watching the sky all my life, being a sea and sky painter, but have never seen such extraordinary effects. One morning, Coniston Old Man (2,600 feet), was quite red, and this before sunrise, when it was almost dark. It never lost its light, but there were no shadows until nine o'clock, when, I suppose, the sun's real light began to reach it. The other evening at a quarter to five, we had cast shadows from the intense glare of illuminated vapour above the sunset, and the crescent moon to the left looking pale blue. ARTHUR SEVERN.

[I have ventured to add to Mr. Severn's letter on Lunar Delineation, a portion of the letter accompanying it, which (as a whole) was not intended for publication.—R. P.]

THE ERUPTION IN THE SUNDA STRAITS.

[1042]—Ceylon has been more or less affected by the volcanic eruption in the Straits of Sunda. Penang also, which is 800 miles off, heard the noise plainly. We are 1,600 miles. I heard the noise as of distant artillery. We had in Colombo, at Guler, and at Point Pedro—west, south, and north of our island—a tidal-wave first to recede, then to advance. At Cape Comorin, south point of India, this extended to half a mile. We presume the agitation of submarine forces was extensive, and had for its centre an island in the Straits of Sunda, which had been silent for 200 years.

A concurrent phenomenon has been the aspect of the sun before setting. He has, from olive green, become pale sea-green, and anon the appearance of a pale full moon, so that the large spot at the left, rather above midway, could be seen without difficulty, as we could gaze at him without the necessity for coloured glass.

The interesting point is whether this green is from the sun's gases, or whether from atmospheric causes around this portion of the earth. I should be glad to know whether during the past week—say back from Sept. 11 inclusive—the sun bore the green aspect in England. Certainly I never saw the sun green before. The weather of late has been abnormal—very dense, white, and leaden-coloured clouds.

If the sun was not green elsewhere—in England, for instance—then we must conclude it is from purely local atmospheric causes hereabouts. If he has looked green at home and elsewhere, then the question reduces itself to whether it has been caused by the earth's unusual atmosphere or from the solar disturbance.

Colombo, Ceylon, *Sept.* 13, 1883. H. L.

GREAT SEA-WAVE.

[1043]—On Aug. 27 the inhabitants of the seashore were thrown into consternation by seeing at about 1.30 the sea suddenly recede, leaving in some places reefs and foreshore dry, and then as suddenly rising to an unusual height half-an-hour afterwards. This continued at intervals all the afternoon, casting boats adrift, stranding them and a lot of fish which were caught napping, and were then promptly picked up by the aborigines. Beyond this no mischief was done here. Most people attributed it to volcanic action (for we are not altogether strangers to these matters, and, indeed, keep an active volcano of our own at Bourbon), and a good many people felt a slight shock. I did not. Probably the shocks would have been more generally felt had they occurred in the evening, or at a time when most people are quiet. We had, however, no idea at the time that the origin of what we saw was so distant, and that we were feeling only the *contre-coup* of the fearful catastrophe of the Sunda Straits. Little by little, news has been received from every part of the Indian Ocean, and it would appear that even as far as the African coast the wave extended. At Tamatave, a friend of mine was sitting with several people on the beach, when, to their amazement, they saw the sea recede so much that the French men-of-war which had just bombarded the place were all but stranded. This was at 3.30. With us the first wave was at 1.30.

It would seem that there is a renewal of volcanic activity in many parts of the world; and of late the light of Bourbon volcano has at times been seen from here at night.

I can hardly see how the things are related, but it is certain that about that time we were favoured with a series of the most extraordinary sunsets and sunrises that I ever witnessed, even here, where we are famous for them. Our Astronomer Royal gives a lame sort of explanation about the passage of light through volcanic dust, but none of that has been seen here. At Seychelles the same phenomena are reported, and there the sun rose in the wrong place one fine morning, and did not get right again till some time late in the morning. [This must refer to abnormal sunlight, not to sun's disc.—R. P.]

If our sunsets had happened in the hurricane season we should have known what to expect, which would have been what the sailors call "beans" (refer to Mr. M.), but in August and September there is no excuse for them.

One sunset in particular I remember. If Turner had painted it, it would have been said that on that day he was either delirious or drunk. I was coming into town one evening by train, at about 5.30 to 5.45 (you are for ten minutes or so in view of the setting sun and a wide stretch of ocean). That evening the sea was a bath of mercury, or molten lead, streaked with black. The sun, but a few degrees above the horizon, was a yellow, blurred opening in the haze; the sky was one mass of streamers of every colour, and what ought to have been blue was leaf-green; the air was orange-colour, and everything was as though seen through a glass of that colour. This strange sight terminated by a performance which is rare in ordinary times, but has frequently appeared of late. The sun sets, and it seems as though night were coming on more rapidly than usual, when, behold! the whole concern lights up again, and it becomes lighter than before. The sun sets, but the light is ghastly and ill-conditioned; ten minutes afterwards all is dark. In the morning the reverse happens. Long before sunrise, the sickly yellow light suddenly glares upon us, making the sky as a grass-plot, and all things hideous; this lasts fifteen minutes, and comparative darkness sets in; then the sun rises as it should. What connection has this with volcanoes? Query. Can you answer?

Port Louis, Mauritius. A CORRESPONDENT.

MOON'S MOTIONS.

[1044]—The nearer any body is to the sun, the more light it will receive, therefore the brighter it will shine, and will appear brighter to an observer on a neighbouring body.

(1.) During a complete revolution of the moon, with respect to the earth, she will vary her distance from the sun about half a million miles. (2.) By the earth's revolution round the sun, the moon is in winter brought three million miles nearer at that time than in summer. So that, viewing the full moon in December, should it not be brighter and larger than the full moon in June, seeing that it is three million miles nearer to the source of light?

Being a science teacher, I have lately been giving lessons on the "Moon," and have endeavoured to explain the longer moonlight of winter than of summer, greater height in heavens, &c., and was struck with the idea mentioned above. I have not seen it mentioned in any text-book I possess.

Another matter I should like to ask your opinion about, and that is—"We may get an idea of its (the moon's) motion round the sun, if we imagine a wheel going along a road to have a pencil fixed

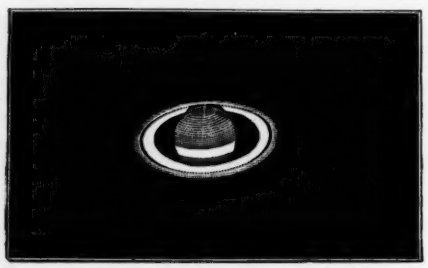
to one of its spokes, so as to leave a trace on a wall: such a trace would consist of a series of curves with their *concave* sides downwards, and such is the moon's path with regard to the sun."—"Elementary Lessons in Astronomy," Lockyer, p. 90.

I had the pleasure of hearing your lecture on the Moon, at Kensington, and noted your effective diagrams on the same subject; and, of course, was puzzled, when I remembered what Mr. Lockyer had said. SCIENCE TEACHER.

[The moon will appear brighter by about one-fifteenth in December—not larger. Of course, the account in extract quoted is quite incorrect.—R. P.]

SATURN.

[1045]—I cannot help thinking "F.R.A.S." will be disappointed with the illustration of Saturn in KNOWLEDGE of Nov. 23. Wood engraving does not lend itself well to the delineation of planetary details. Better, I should say, to have omitted the shading on the ball entirely rather than represent such a bright object so black. Then, again, the rings do not appear satisfactory to me. On looking at the planet the same evening with a good 3¼ O.G., I was so



Saturn, Nov. 23, 1883, 11.45 p.m. (3¼ in. Wray, power 250).

struck with the difference that I took the trouble to make a careful drawing (of which I enclose a tracing), showing exactly what I saw. The "crape ring" was only at times glimpsed in the ansæ, and it was better seen on the left than on the right. The square-shouldered aspect of the shadow on the ring was remarkable, though perhaps I have somewhat exaggerated it in the drawing.

H. H.

LARGE METEOR.

[1046]—The sky being very clear last evening (Nov. 28), I was out in the garden with my telescope, and about 10.35 I was looking in a south-westerly direction searching for 51, Piscium, when suddenly I perceived that something unusual was taking place overhead and somewhat behind me, for the sky had suddenly become brilliantly illuminated from that direction, and on turning my head up to ascertain the cause, there I beheld a great fire-ball or meteor, with a long tail of sparks, gliding across the sky from south to north. The whole apparition did not occupy more than five or six seconds of time, and as it was rather of a startling nature, I had scarcely time or presence of mind to note its path exactly; but, as far as I can say, it was about as follows:—When I first saw the meteor it was near π^1 Orionis, from thence it passed about one degree east of ζ Tauri, and about two degrees west of θ Gemini, across Lynx, and finally disappeared just before reaching v Ursa Majoris. The ball itself was apparently almost as large as the full moon, and the front or leading part of it was of an intense white colour, while the back part, just where the tail commences, was purplish-blue, and the tail or train itself was composed of red sparks, which issued from it in its flight, and gradually died out at a distance of about three or four degrees from the ball. It was a magnificent sight while it lasted, the whole sky being illuminated as if by a lingering flash of lightning, the meteor maintaining its brilliance until it was crossing Lynx, when it there began to fade gradually, and finally disappeared at the point named above, by dying out, apparently without any explosion, and I did not notice any noise accompanying it at all. As regards its distance from the earth, it really appeared to be very near; I might almost say that it did not seem to be above two or three hundred yards from me, and I hope it may have been observed by some one else, at some distance from here, who would be able to give you its apparent path from their point of view, so that you might be enabled to ascertain its actual distance. It resembled in many respects the large meteor I saw on the evening of May 4, 1882, and which I described in a letter (435) in KNOWLEDGE of June 23, 1882.

Huddersfield, *Nov.* 29, 1883. EXCELSIOR.

TRICYCLING IN WINTER.

[1047]—I can endorse Mr. Browning remarks as to the pleasure of going over frozen roads; but be careful to see your lamps are all right, as the oil soon freezes. Can Mr. Browning give us any experience of the Omnicycle? I have no fault to find with mine, but should like to know his views. I also want to know what speed can be attained and kept up on it. I am unable to test this, being very weak. JOHN ALEX. OLLARD.

CONVERTIBLE "SOCIABLES."

[1048]—In answer to E. B., who asks what is the swiftest, safest, and cheapest Convertible Sociable, I do not know any machine which possesses all these good qualities in itself. I should say that the "Cheylesmore" Convertible Sociable, made by the Coventry Machinist Co., is one of the swiftest, and that the "Europa" Convertible Sociable, made by the St. George's Foundry Co., is the safest and cheapest machine I have yet seen. In reply to the second query, I have said very little respecting Convertible Sociables in any of my articles. I think them very inferior to machines that are not convertible generally, but I must except the "Europa" from this criticism—it is as solid in the double form as in the single, but it is more difficult to make the conversion.

JOHN BROWNING.

SHAKESPEARIAN INSECTS.

[1049]—"Letters on the Natural History of the Insects mentioned in Shakespeare's Plays," by Robert Patterson (London, 1838), is in my possession—an interesting but discursive book. The subject well deserves more recent treatment. J. KIRKMAN.

S. Stephen's Vicarage, Hampstead, N.W., *Dec.* 8, 1883.

COALFIELD MEN.

[1050]—Apropos of Mr. Grant Allen's remarks on Anthropometry, the following quotation is interesting. It is from Frank Buckland's "Curiosities of Natural History":—"The geological formation of a district, I found in examining recruits for the regiment, has considerable effect upon the stature of its inhabitants; coal-producing countries as a rule generally grow the tallest, and at the same time, the largest-boned men." DORA HOPE.

ORIGIN OF THE WORD "MASHER."

[1051]—I can trace "Mash" and "Masher" back a good deal further than 1878. The words were in common use in San Francisco as far back as 1875; and in 1876, at Bush-street Theatre, I remember a riddle given by the Minstrels then performing there, "Why are San Francisco ladies like well-boiled potatoes?" with the reply, "Because they are so easily mashed." A reference to the San Francisco *Chronicle* about these years will show that the term "Mashers" was applied to the young men who waited outside theatres to "mash" the ladies leaving there on *matinées*, which, as you know, are held every Saturday afternoon, and are attended largely by ladies. The "dude" in San Francisco was, and is, called "a statue," or "Kearney-street Statue," from their habits of posing themselves on street corners to "mash" the girls.

SAN FRANCISCO.

WEATHER FORECASTS AND HOW TO MAKE THEM.

[1052]—Allow me to correct a slight inaccuracy which I notice in Mr. Browning's otherwise excellent article on "Weather Forecasts," &c. I refer to the word "weeks," in the paragraph in which my name appears; this ought to read "months."

Mr. Browning recommends Grace's Spectroscope to those who experience difficulty in seeing the Rainband with the instrument depicted in Fig. 1., but I think it would be as well to keep as much as possible to one form of spectroscope for meteorological purposes. The latter kind is now being used by hundreds of observers, and to my mind, taking it altogether, is the better of the two for prognosticating weather.

The more I use the "Rainband Spectroscope," and compare its indications with the weather experienced, the more it seems to me that its name is a misnomer. The rainband is not the principal feature in the sky spectrum; there are others of equal importance to take into consideration, *e.g.*, the dry air bands at α and β, the moist-air bands at a and v, &c.

The instrument is essentially a hygroscope and spectroscope combined, and, with these reasons in view, I have ventured to coin a new word for this particular modification of the spectroscope, and would suggest calling it in future "The Hygrospectroscope."

F. W. CORY.

FEEDING CHAMÆLEONS.

[1053]—"H. Smith" should keep his chamæleons in a warm place, and feed them on insects, if procurable; but they are able to live for several months without food of any kind.

LUMINOUS BEETLE.

[1054]—Seeing a correspondent writes you on luminosity of animals, allow me to say that I have seen the same phenomena, not only with centipedes, but also with the common little garden beetle (what his proper name is I do not know), but that I was able to take the fellow home, and had a good examination. The phosphorescent matter adhered to my fingers when I picked him up, and there was an offensive odour connected with it, which I attributed to having been among some decayed matter. I do not know if that would cause it. FRED. F.

PERFORATED STONES OF INDIA.

[1055]—Permit me to answer your correspondent "Cosmopolitan" (No. 1018), in reference to the perforated stones of India and elsewhere.

The fullest information possible can be gained from General Forlong's magnificent work, called "Rivers of Life," published by Quaritch. Vol. II. contains many pages devoted to this subject.

CHARLES VOYSEY.

LETTERS RECEIVED AND SHORT ANSWERS.

STUDENT.—Cannot indicate books and prices of books on economic science.—W. MOTTON. Applications became so numerous that have had long since to withdraw that offer.—T. W. SCHAFFNER. Lines mentioned were not enclosed; but in any case personal characteristics, however estimable, could hardly be referred to in these columns.—H. CLARKE. If you skid the wheel the top moves no faster than the bottom; but if you let her run the top point moves twice as fast as the centre and infinitely faster than the bottom point, which is momentarily at rest.—SUNSHINE. See Mr. Ranyard's most interesting article in our last number.—A. M. D. Thanks for the creatures taken from the soft roe of a bloater: I do not know them.—E. FRANKLYN. Anxious, like Mr. Sala, to avoid the workhouse; I am obliged to decline to "send answers, worked out," to puzzles: but the answer, worked out, appears in KNOWLEDGE for Nov. 23, p. 318.—F. L. HARRIS. The subject (watch-spring dissolved) was discussed in KNOWLEDGE a few months ago; being away from home, cannot refer to index. Of course the molecular condition of the watch-spring being affected by tension, the circumstances under which dissolution takes place (time and resulting condition of the acid) are different, and all the energy of tension may be thus accounted for; though equally of course the inquiry would be a very delicate one.—E. C. H. You must take into account both the westerly longitude of Worthing, which would make the time of sunset a little later by Greenwich time, and the difference of latitude which makes the day at Worthing in winter a little longer than at Greenwich, or hour of sunset later. Due account taken of these points, the hour given by the almanac for the sun's centre is about right; but as refraction is variable, you must not expect exactness.—J. SQUIRE. Fleeming Jenkin's "Electricity and Magnetism" and Sprague's "Electricity" should answer your purpose.—THOMAS LAWS. Quite agree with you.—H. E. I suppose some folk noticed on several occasions that spring evenings when the moon was new had been wet, and concluded that the poor moon had something to do with the matter. At any rate it is when the moon is new in spring evenings (or when she is old in autumn mornings) that she is "on her back." If it chanced to be wet on such occasions a few times the weather saw makers would be bound to light on the discovery that

When the moon is on her back,
She holds the water in her lap.

—H. H. Thanks. Mr. W. M. Williams has already expounded his views about the Moon, Jupiter, &c., in "Fuel of the Sun." They *are* rather dismal astronomy, it's a fact.—REGULAR READER. Ursŭla certainly; Mirándŭla and Staŭpitz, "au" as in *frau*, I should say; but such matters are outside our line.—J. E. F. The only grammar rule I remember relates to that subject, "Where Contingency and Futurity are both implied the verb should be in the subjunctive." It always seemed to me so wise to teach children (I was nine when I learnt this rule) about Contingency and Futurity and implying, and subjunctive. Where teachers were so idiotic, what progress were the taught likely to make?—HENRY CLARK. I am *quite* serious in saying that to speak of "man rising to the heavenly bodies" is not more exact than to speak of "the heavenly bodies rising to man." The former expression has the disadvantage of being absurd as well as inexact. *Did* you ever rise to the sun? You know very well you never did. If as you say, facts require exactness of knowledge, then, instead of telling your children that "we rise to the sun," which is nonsense, you ought to speak of sunrise thus, or in words to this preposterous effect,—"Owing to the earth's rotation on her axis, the horizon plane—but pshaw! that's not exact—the curved surface formed by those lines of sight which appear to be directed towards the visible horizon line, but in reality, owing to atmospheric refraction, pursue a curved course till they pass beyond the limits of our atmosphere—this curved surface, I say, is so shifting its position in space, that, whereas it had passed above the sun, using the word 'above' with reference to my actual position at the moment, it is now passing athwart his disc, and will presently pass wholly below his globe—so that, whereas in its former position I could see no part of the sun, I now see a part of his disc, and presently the whole will be visible to me; by which I by no means wish to imply that he is actually where I seem to see him, or rather a part of him, but only that light-waves, which emanated from him rather more than eight minutes ago are falling on the retina of my eye, and received by the optic nerve are producing their particular impression which we call 'seeing,' and here I would correct an inexactness in what I have just said; I spoke of the rotation as the earth, I should have said the combined rotation and revolution, for inasmuch as the revolution of the earth round the sun affects the length of what we (very inexactly) call 'the solar day,' it must modify the rate at which the curved surface above mentioned moves amid space." That is a beginning, but a whole number of KNOWLEDGE would be required to express the matter properly. On the whole, I prefer for the present to say "The sun is rising." It is not only more convenient but more exact. For note that the direction of above and below are changing all the time, and that therefore in a sense perfectly defensible the sun rises. Your references, by the way, to Galileo, show that if you aim at superexactitude in astronomy, you pay less attention to exactness in matters of historical fact. Galileo did not discover that the earth rotates, nor even (though the imprisonment you refer to had more reference to that) that it revolves. If you must enthuse so warmly as you do in your letter, do try to enthuse over the right man.—F. W. G. There is no contradiction. Professor Smyth expressed the opinion that excess of aqueous vapour may account for the green sun in India, not for the recent red sunsets.—D. MACKAY. Will try to find space.—J. A. OLLARD. "Flowers of the Sky," written I think in 1873.

Our Chess Column.

By MEPHISTO.

THE BOOK OF THE TOURNAMENT.

SECOND NOTICE.

OUR aim has always been to discourse on Chess play, and to treat all subjects closely allied to the game, from a scientific point of view. Accordingly, under ordinary circumstances, the rules and regulations of the Tournament—a matter of history—would not have been considered by us as a profitable subject for criticism. But in his introduction to the book the Editor does not content himself with merely giving us those rules and regulations, but he evidently desires, and recommends, the acceptance of his opinions upon each question by the Chess community, no doubt with the very laudable object in view of providing precedents for the guidance of conductors of future Tournaments. Under these circumstances we should be failing in our duty if we should leave unchallenged some of the laws and theories recommended by the Editor.

Thus the Committee were not content with giving us the rules of their Tournament, but have added the words, "published for the consideration of Chess-players, and especially of the managers of future International Chess Tournaments." These rules have been drawn up by Messrs. Donnesthorpe and Woodgate. They are not sufficiently comprehensive to rank either as rules for English Chess-players or as an International code. In the first instance, only a representative committee would be competent to draw up these rules—say, for example, Messrs. Donnesthorpe, Woodgate, and Minchin on the one side, and Messrs. Blackburne, Zukertort, and Steinitz on the other side, with Mr. Lewis as chairman. The rules contain a few stipulations that are unnecessary, while a great many necessary laws are not dealt with at all.

Section 8 says "A player may at any time call upon his adversary to mate him within fifty moves. If by the expiration of such fifty moves no piece or pawn has been captured, nor pawn moved

nor mate given, a draw can then be obtained." This may be best described as a vexatious law. We think the Editor was bound to omit this rule, as at an early stage of the Tournament the Committee abolished it, as it was found to be quite impracticable. A suggestion of a similar kind made by Dr. Lange before the commencement of the Nuremberg Tournament was by all players present declared to be unworthy of discussion.

Rule 8 of the programme provides that only the third draw should count as half to each player. In reference to this rule the Editor states that "a section of the English Chess players, supported by their partisans in the Chess press," were opposed to this rule. We do not think the Editor was justified in publicly ascribing the criticism of the Chess press to partisanship. If the latter does exist Mr. Minckin, in his position as hon. secretary of the most important Chess organisation of the country, will, we hope, find plenty of opportunities to discountenance such practices. We still think the objection to this rule well founded, although we always admitted that something was required to be done to check mere playing to the score by draws.

We are told that the opinions expressed (by letter) of probable English and foreign competitors of the tournament were largely in favour of the draws not counting. While not wishing to deny this as a fact, we beg to remind the Editor of the following equally important fact—that a day or two before the tournament most of the foreign competitors were holding meetings and loudly clamouring for the abolition of Rule 8, and that a majority of the competitors were decidedly opposed to it. In reference to this rule, the Editor tells us: "I considered it our duty to devise rules that should most effectually crush the weak, and discover by selection the strongest." We hope, for the sake of Chess and rising Chess-players, that future committees will never again adopt this perverted application of an equitable doctrine well known in legal and sporting practices—namely, that leniency should be inclined on the side of the weak. We fail to see why a weak player should be prevented from playing to draw (however undesirable that may be) if by the same rule *a strong player is enabled to play for a draw in a doubtful position against* a weaker player, relying upon three games to scoring one. In fact, we think the question may be reduced to a problem in simple arithmetic. English scored 15½; Mackenzie, 15½; and Mason, 15½. English played 45 games; Mackenzie, 41 games; and Mason, 39. We decidedly assert that Mackenzie's performance is a better one than that of English, and that Mason has proved himself stronger than either of the two, and that, therefore, both these players have been wronged by Rule 8, but for which English must have ranked below them. But the Editor himself admits the impracticability of Rule 8 by recommending its modification to "Where two opponents have drawn, *and are satisfied with that result*, the draw should be allowed to be final."

The Index is capable of much improvement. It cannot be ascertained from it where the score-sheets, rules, laws, &c., are to be found. Each player ought to have had his games given complete under his name, regardless of the double references, and that in alphabetical order. An index of the games arranged according to the openings would likewise have been welcome.

Our next notice will be devoted to the more congenial task of examining the analytical contents of the book.

ONE OF A NUMBER OF GAMES PLAYED BY MR. BLACKBURNE AT THE WHITEHAVEN CHESS CLUB.

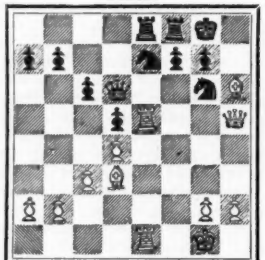
French Defence.

White. J. H. Blackburne.	Black. J. B. Mason.
1. P to K4	P to K3
2. P to Q4	P to Q4
3. Kt to QB3	Kt to QB3
4. Kt to KB3	B to QKt5 (*a*)
5. B to Q3	Kt to K2 (*b*)
6. Castles	Castles
7. KP takes P	P takes P
8. Kt to K2	Kt to Kt3
9. Kt to Kt3	B to KKt5
10. P to QB3	B to Q3
11. P to KR3	B takes Kt
12. Q takes B	QKt to K2
13. Q to KR5	P to QB3
14. B to Q2	Q to B2
15. QR to K sq	B takes Kt
16. P takes B	Q takes P
17. R to K3 (*c*)	Q to Q3 (*d*)
18. KR to K sq	QR to K sq
19. R to K5	P to KR3
20. B takes P (*e*)	Kt to B5 (*f*)

White. J. H. Blackburne.	Black. J. B. Mason.
21. B takes Kt	P to Kt3
22. Q to R6	Resigns

Position after White's 20th move.

Black.



White.

NOTES.

(*a*) Not good; B to K2 is the proper move.

(*b*) K2 is an inconvenient square for the KKt in this opening.

(*c*) White is fully compensated for the Pawn by getting his Rooks into full play; the combination which follows is highly interesting.

(*d*) B2 would have been a far better square for the Q.

(*e*) Delightful play. Black's best course would have been to have taken the B, when the game might have continued as follows:—P takes B. 21. Q takes P, Q to B3 (to provide against R to R5). 22. P to KR4, Q to Kt2 (if Q takes P. 23. R to R5, Q takes R (ch). 24. K to R2, and wins). 23. Q takes Q (ch), K takes Q. 24. B takes Kt, P takes B. 25. R takes Kt (ch), with the better game. See diagram in the previous column.

(*f*) This is useless. To take the Rook was not so good as it looked. The game might have proceeded as follows:—Kt takes R. 21. B takes P (if now K takes B, White will win the Q in two moves, by Q to R7 (ch), &c., but will have given two Rooks for it). If Kt (K4) to Kt3, then follows 22. B to K5, Q to Q2. 23. R to K3, P to B3 (if P to B4, then 24. R to R3). 24. R to Kt3, R to B2. 25. B takes Kt, Kt takes B. 26. R takes Kt (ch), R to Kt2. 27. B takes P, R takes R. 28. Q takes R (ch), K to B sq. 29. Q to R6 (ch), K to B2. 30. Q to Kt7 (ch), K to K3. 31. Q to Kt4 (ch), K to Q3. 32. B to K5 (ch), K to K2. 33. Q to Kt5 (ch), K to B sq. 34. Q to R6 (ch), K to B2. 35. Q to Kt7 (ch), K to K3. 36. Q to B6, mate. If, on the other hand, Black at any time exchanges R for B, then, of course, White wins by superiority of Pawns.

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Note.—*All communications respecting Lectures should be addressed to Mr. John Stuart, Royal Concert Hall, St. Leonards.*

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